

Calculating our Ecological Footprint

Description:

Humans have a large impact on natural and built environments. In this lesson, students should begin to understand how our choices affect the planet. Students will compare behaviors to determine which have a lower carbon footprint. Then, students will measure their own ecological footprint using an online calculator based on their personal actions.

Objectives:

- Understand carbon and ecological footprints
- Identify behaviors that can decrease human impacts on the environment
- Appreciate how daily choices have a significant impact on our environment

Vocabulary:

Carbon footprint, combustion, ecological footprint, fossil fuels, renewable energy

Materials:

- Computers, laptops or tablets with internet access
- Copies of the “Calculating our Carbon Footprint Worksheet” printed for each student
- 1 copy of the “Calculating our Carbon Footprint Worksheet Answer Key”
- Writing utensils

Background Information:

Footprints are marks we leave on the Earth. Our ecological footprint is the measurement of our impact on the Earth based on the activities we do every day. Driving a car for example, has a bigger impact than riding a bicycle. Our diet can have a particularly large impact on our ecological footprint. For instance, one gram of beef produces 250 times the emissions of one gram of legumes.¹ This is because the inputs that are required to produce these goods are vastly different.

Energy is an important aspect of our ecological footprints. In today’s economy, much of our energy is sourced from fossil fuels. Fossil fuels produce carbon dioxide through the process of combustion (hydrocarbon + oxygen = carbon dioxide + water). Carbon footprints are used to calculate the amount of carbon emitted from the fossil fuels we use. Watch [Fuse School’s What are Carbon Footprints?” video](#) for more information on how we can decrease our carbon footprints.

While most of our energy comes from fossil fuels, not all energy comes from carbon-based sources. This energy is known as renewable energy. Renewable energy can come from the wind, sun, water, and biomass. Some examples of renewable energy include solar panels, hydroelectric dams, and wind turbines. Renewable energy releases insignificant amounts of carbon dioxide compared to fossil fuels.

¹ [Springer Nature Journal Article “Global diets link environmental sustainability and human health”](#)

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It is difficult to avoid the use of fossil fuels in our daily lives; however, we have the power to significantly decrease this by simply shifting some of our daily habits. Some things, like the type of energy we use at home, are often out of our control, but there are many decisions we make every day related to our footprints that we might not be aware of. Being mindful of the transportation methods we use, the places we buy our goods from, and the many opportunities we have to conserve energy and water at home and at school are significant ways we can reduce both our carbon and ecological footprints.

Method:

Part I:

- Ask students to think about what is included in their carbon footprint with an emphasis on energy and fossil fuels. Be sure to compare and contrast the impacts of fossil fuels to renewable energy.
- Pass out the Calculating our Ecological Footprint worksheet. Instruct students to choose the answer that they believe will have the smallest impact on the environment (lowest carbon emissions). Allow students ample time to complete the worksheet.
- As a class, review the answers to the worksheet. Use the answer key to discuss responses. Did students find it challenging to choose between actions?
- Ask students, which of our daily activities were addressed most in the Carbon Footprint Quiz? Why? This encourages students to discuss which actions have the biggest environmental impact.

Part II:

- Introduce the concept of an ecological footprint. Discuss the factors that influence our ecological footprint and how the environmental impacts of each range based on greenhouse gas emissions: diet, energy usage, housing, transportation, shopping habits, etc.
- Using computers, allow students to calculate their own ecological footprint using the [Ecological Footprint Calculator](#). As students explore this tool, encourage them to consider the ways in which their footprint in NYC differs from people who live in rural or suburban areas.
- Students will use the slide bars and multiple choice questions to select the options that best describe their lifestyles.
- Have students write their results on the board. Be sure to mention that the results are in two different measures. The first result is in number of Earths. This denotes how many planet Earths the world would need if everyone had the same behavior as the person taking the quiz. A number greater than 1 indicates that the ecological resources and services used are more than the planet can regenerate. As of 2018, human behaviors would require approximately 1.7 Earths to support humanity's demand on Earth's resources. The second result is the Earth overshoot date. Earth Overshoot Day marks the date when humans have used more from nature than Earth can renew in the entire year. In 2018, this day fell on August 1. Discuss and interpret the results as a class.

Discussion:

- Which personal behaviors impact your carbon and ecological footprints most?
- How does your energy use impact your ecological footprint?
- What are the differences between renewable and traditional energy forms?
- How can you alter your behavior to decrease your footprints as an individual? As a school? Community? Identify some small and large scale changes and discuss the pathways for shifting behavior at each scale.

Extension:

- Challenge students to retake the online quiz, but have students select answers with the lowest ecological footprint. Discuss how we can incorporate behaviors with lower ecological footprints into our lives.
- If appropriate, challenge students to make 3-5 changes to reduce their eco-footprint based on their initial results. After a week, ask students to retake the quiz to see how

their changes impact their results. Discuss the challenges that students may have experienced (or not) and consider additional changes they would like to make.

- Explore the [Global Footprint Calculator](#) [Open Data Forum](#) to see ecological footprint data from around the world and compare the impacts of various countries.
- Use the virtual [Water Footprint Calculator](#) with your students to determine personal water usage. Discuss how water fits into our ecological footprint? How much water do we use every day? How can we decrease our daily water usage?

NYC Department of Environmental Protection
educationoffice@dep.nyc.gov

For more information visit www.nyc.gov/dep

Ecological Footprint Quiz Answer Key

Description:

A footprint is a mark we leave on the Earth. Our carbon footprint is the measurement of carbon emitted by the activities we do everyday. Below are the options with lower carbon footprints and a brief description for each. It is important to remember that not all answers are always black and white! To be mindful stewards of the Earth, we should consider our daily actions and the impacts they have on the environment. This answer key is designed for educators but can be adapted for students.

1. A: Turn the lights off when no one is in the room

Lightbulbs are powered by electricity so making sure to turn the lights off when leaving a room is a great way to conserve electricity. Another way to increase efficiency with lighting is to switch all of your bulbs to energy-efficient lightbulbs, like “halogen incandescents, compact fluorescent lamps (CFLs), and light emitting diodes (LEDs).”²

2. A: Take a 5 minute shower

While New York City’s water supply system is mostly gravity-fed and filtered by nature, it still requires energy and significant investment to manage, protect, and supply about 1 billion gallons of high-quality drinking water each day from the City’s three upstate watersheds (as far as 125 miles away!). Therefore, water inefficiency implies energy inefficiency, and energy and our carbon footprint are very closely correlated. A 5 minute shower would use anywhere from 7.5-15 gallons of water, depending on the efficiency of your showerhead, whereas a bath typically requires about 30-45 gallons of water. It’s important to remember that our water supply system relies

entirely on the availability of a limited resource, freshwater.

3. B: Buy food at a local farmer’s market

The distance food travels to reach the consumer plays a big part in the carbon footprint of consuming that food. Produce sold at farmer’s markets is usually grown locally, which requires less fossil fuels in transporting the goods from the farmer to the consumer and is one of the reasons shopping at farmer’s markets is usually the less-carbon intensive option.

4. B: Source energy from solar or wind

The combustion of fossil fuels is extremely carbon intensive, making it one of the biggest contributors to global climate change. Solar and wind energy provide less carbon intensive alternatives to fossil fuels.

5. A: Refill a reusable water bottle

Plastic water bottles require massive amounts of energy to produce -- as single use items -- this process is extremely inefficient. Single-use plastic products can also get into our waterways as litter, if not properly recycled or disposed of. NYC Department of Environmental Protection

² [U.S. Department of Energy “How Energy-Efficient Light Bulbs Compare with Traditional Incandescents”](#)

provides New Yorkers with quality drinking water. Alternatively, make a one-time purchase of a BPA-free water bottle and refill it with tap water! Learn more about how bringing a [reusable water bottle](#) with you can help New York City and the environment.

6. A: Throw food scraps away in a compost bin

NYC Department of Sanitation is currently collecting food waste from residents, schools and other city buildings, and is continuing to expand its program citywide. Collected food waste can be composted to create soil products for beneficial use, rather than end up in a landfill as waste. One third of New York City's waste consists of food scraps and yard waste, learn more about [compost collection](#) and the City's [Zero Waste](#) plan. NYC Department of Environmental Protection is currently receiving some collected food waste at its Newtown Creek Wastewater Resource Recovery Facility in Brooklyn, NY, which helps generate renewable natural gas for the facility and the community.

7. B: Bring reusable bags to the store

Like plastic water bottles, plastic bags require energy to produce, and a reusable option like a canvas tote bag is a great way to reduce your carbon footprint by decreasing the amount of plastic bags produced and quickly sent to a landfill after its use. Plastic bags can often end up on our streets as litter, as well as in our waterways. Learn more about New York State's [plastic bag ban](#) and how using [reusable bags](#) helps our city and the environment.

8. A: Throw a used tissue in the trash

Throwing away trash, like a tissue, by flushing it down the toilet instead of throwing it in the garbage wastes large amounts of water (approximately 1.3-5 gallons per flush). Wastewater from our homes, schools, and businesses travels through sewers pipes to a wastewater resource recovery facility, where it requires a significant amount of energy to pump, treat and disinfect our used water and waste. Additionally, putting other types of waste down our drains can impact the City's sewers and facilities, learn more about the [Trash It. Don't Flush It.](#) campaign. Throwing garbage in a proper waste receptacle is much more efficient, but we should always work towards reducing the amount of waste we produce.

9. A: Take the subway

Public transportation is always more efficient than driving! According to the American Public Transportation Association, "Public transportation's overall effects save the United States 4.2 billion gallons of gasoline annually."³ Furthermore, "Communities that invest in public transit reduce the nation's carbon emissions by 37 million metric tons annually."²

³ [American Public Transportation Association Public Transportation Facts](#)

Name: _____

Date: _____

Ecological Footprint Quiz

Footprints are marks we leave on the Earth. Your carbon footprint is the measure of carbon emitted by the activities we do every day. Complete this quiz by selecting the option with less carbon emissions. See the answer key for an explanation of the correct choices.

1.

a.

☐

Turn the lights off when no one is in the room

b.

☐

Keep them on when no one is in the room

2.

a.

☐

Take a 5 minute shower

b.

☐

Take a bath

3.

a.

☐

Buy food at the grocery store

b.

☐

Buy food at the local farmer's market

4.

a.

☐

Source energy from fossil fuels

b.

☐

Source energy from solar or wind

5.

a.



Refill a reusable water bottle

b.



Buy a plastic water bottle

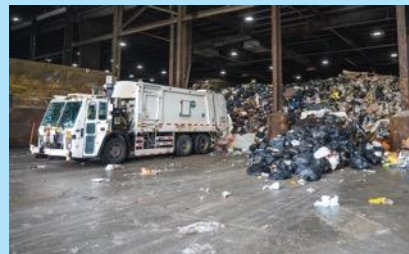
6.

a.



Throw food scraps away in a compost bin

b.



Throw food scraps away in the garbage

7.

a.



Use plastic bags when checking out at the store

b.



Bring reusable bags

8.

a.



Throw a used tissue in the trash

b.



Flush a used tissue down the toilet

9.

a.



Take the subway

b.



Take a taxi